

REMARKS

Please find attached a fee for an excess of seven (7) claims above that total of claims previously paid for.

Claims 1-3, 6-13, 16-22, 25-28, 30-34, 38-46, and 49-62 are pending in the application. This Amendment currently amends claims 1-3, 8, 9, 11-13, 18, 19, 21, 26-28, 32, 33, 38-45, 49, and 50. Claims 4, 5, 14, 15, 23, 24, 29, 35-37, 47, and 48 are canceled without prejudice or disclaimer. New claims 51-62 are added. No new matter is added to currently amended claims 1-3, 8, 9, 11-13, 18, 19, 21, 26-28, 32, 33, 38-45, 49, and 50, or to new claims 51-62. Claims 1-3, 8, 9, 11-13, 18, 19, 21, 26-28, 32, 33, 38-45, 49, and 50 are currently amended to merely clarify the subject matter of the claims and in no way narrow the scope of the claims in order to overcome the prior art or for any other statutory purpose of patentability.

Notwithstanding any current claim amendments of the current Amendment or those amendments that may be made later during prosecution, Applicants' intent is to encompass equivalents of all claim elements. Reconsideration in view of the foregoing amendments and the following remarks is respectfully requested.

Claims 43-45 stand rejected under 35 U.S.C. §112, first paragraph.

Claims 1-3, 5-10, 21, 26-34, 38, 40, and 41 stand rejected under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 6,252,254 to Soules et al. (hereinafter, Soules), in view of U.S. Patent No. 5,847,507 to Butterworth et al. (hereinafter, Butterworth), U.S. Patent No. 5,798,536 to Tsutsui, and U.S. Patent No. 5,877,558 to Nakamura et al. (hereinafter, Nakamura). Claims 11-13, 15-20, and 39 stand rejected under 35 U.S.C. §103(a) as unpatentable over Soules, Butterworth, Tsutsui, and Nakamura as applied to the claims above, and further in view of U.S. Patent No. 6,153,123 to Hampden-Smith et al. (hereinafter, Hampden-Smith). Claim 25 stands rejected under 35 U.S.C. §103(a) as unpatentable over Soules, Butterworth, Tsutsui, and Nakamura as applied to the claims above, and further in view of U.S. Patent No. 6,166,489 to Thompson et al. (hereinafter, Thompson). Claims 43-46, 49, and 50 stand rejected under 35 U.S.C. §103(a) as unpatentable over Soules, Butterworth, Tsutsui, and Nakamura as applied to the claims above, and further in view of

U.S. Patent No. 6,340,824 to Komoto et al. (hereinafter, Komoto).

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

The claimed invention, as defined in independent claim 1, is directed to a light-emitting apparatus that comprises a primary light source comprising a GaN semiconductor light-emitting device that emits a first light of a wavelength of 380 nm to 500 nm, the GaN semiconductor light-emitting device including a single reflective layer disposed on a surface of a substrate on which no light-emitting layer is formed, and a transparent electrode disposed above the single reflective layer, and a leadframe comprising a cup portion including a bottom surface on which the GaN semiconductor light-emitting device is mounted, a secondary light source comprising a fluorescent material that comprises at least one of ZnS:Cu, Au, Al; ZnS:Cu, Al; ZnS:Cu; and Y₂O₂S:Ce, and a fluorescent material resin, the fluorescent material being dispersed within the fluorescent material resin, and the fluorescent material resin being contained in the cup portion, and a sealing member that focuses light emitted from the light-emitting apparatus, the sealing member being disposed above the secondary light source, in which the fluorescent material absorbs the first light of a first wavelength and emits a second light of a second wavelength, which is greater than the first wavelength.

The claimed invention, as defined in independent claim 11, is directed to a light-emitting apparatus that comprises a primary light source including a GaN semiconductor light-emitting device that emits a first light of a wavelength of 380 nm to 500 nm, the GaN semiconductor light-emitting device including a single reflective layer disposed on a surface of a substrate on which no light-emitting layer is formed, and a transparent electrode disposed above the single reflective layer, and a leadframe comprising a cup portion including a bottom surface on which the GaN semiconductor light-emitting device is mounted, a secondary light source comprising a fluorescent material that comprises at least one of ZnS:Eu and Y₂O₂S:Ce, and a fluorescent material resin, the fluorescent material being dispersed within the fluorescent material resin, and the fluorescent material resin being contained in the cup portion, and a sealing member that focuses light emitted from the light-

emitting apparatus, the sealing member being disposed above the secondary light source, in which the fluorescent material absorbs the first light of a first wavelength and emits the second light of a second wavelength, which is greater than the first wavelength.

The claimed invention, as defined in independent claim 21, is directed to a light-emitting apparatus that comprises a first light source including a GaN semiconductor light-emitting device that emits a blue light, the GaN semiconductor light-emitting device including a single reflective layer disposed on a surface of a substrate on which no light-emitting layer is formed and a transparent electrode disposed above the single reflective layer, and a leadframe comprising a cup portion including a bottom surface on which the GaN semiconductor light-emitting device is mounted, a second light source including a first fluorescent material that absorbs the blue light emitted by the first light source and emits a green light and a fluorescent material resin, the first fluorescent material being dispersed within the fluorescent material resin, and the fluorescent material resin being contained in the cup portion, a sealing member that focuses light emitted from the light-emitting apparatus, the sealing member being disposed above the secondary light source, and a third light source that emits a red light, in which the blue light emitted by the first light source, the green light emitted by the second light source, and the red light emitted by the third light source are mixed to thereby generate white light.

The claimed invention, as defined in independent claim 42, is directed to a light-emitting apparatus that comprises a box including a cup portion including a bottom surface, the bottom surface including a first electrode and a second electrode, a primary light source including a GaN semiconductor light-emitting device that emits a first light of a wavelength of 380 nm to 500 nm and is fixed to one of the first electrode and the second electrode, the GaN semiconductor light-emitting device including a single reflective layer disposed on a surface of a substrate on which no light-emitting layer is formed, and a transparent electrode disposed above the single reflective layer, and a secondary light source including a fluorescent material that comprises at least one of ZnS:Cu, Au, Al; ZnS:Cu, Al; and ZnS:Cu, and a resin, the fluorescent material being dispersed within the resin, and the resin being contained in the cup portion, in which the fluorescent material absorbs light of the first wavelength and emits light of a second wavelength, which is greater than the first

wavelength.

II. THE PRIOR ART REJECTIONS

A. The Soules Reference

As admitted by the Examiner, Soules does not appear to disclose a structure of a lead frame having a cup-shaped portion (Office Action, page 4, lines 3 and 40).

B. The Butterworth Reference

Fig. 1 of Butterworth illustrates a prior art white LED 100 that includes a blue emitting gallium nitride (GaN) die 110 mounted on a reflector cup lead frame 120 (col. 1, lines 31-35). A blob of cerium (Ce) activated yttrium aluminum garnet (YAG) phosphor 130 is placed on top of the LED die 110 (col. 1, lines 36-38).

Butterworth discloses that the addition of a phosphor layer to a blue die permits the development of an efficient light emission source of various wavelengths (col. 1, lines 44-45). However, this technique is not a panacea (col. 1, line 46). The addition of the phosphor layer adds an extra step to the manufacturing process of the LEDs (col. 1, lines 46-48). To quickly meet customer demand, inventories for a wide range of color LEDs must be maintained, with each color having a different phosphor layer (col. 1, lines 48-51).

To overcome the problem of the above-mentioned additional manufacturing step, i.e., adding a phosphor layer, and to reduce inventories, Butterworth's invention discloses a lens 240, containing a fluorescent die, that covers the blue light emitting die 110 and a reflector cup lead frame 120 (Fig. 2 and col. 2, lines 55-62).

Furthermore, the lens is formed during the last step of the manufacturing process (col. 2, lines 20-21). Because the color of the LED is defined by what dyes are added to the lens, one can reduce inventory by maintaining a stock of lens-less LEDs (col. 2, lines 21-24). Then, when a particular color LED is required, the lens is formulated and added to the lens-less base stock (col. 2, lines 24-26).

C. The Tsutsui Reference

Tsutsui is cited for disclosing a GaN emitter formed on a sapphire substrate and for

teaching that the GaN chip may further possess a light reflection film 11 on the rear side of the sapphire substrate for reflecting light that is directed toward the substrate and back toward the front, upper light emission surface (Office Action, page 5, section e.(i.)).

D. The Nakamura Reference

Nakamura is cited for teaching GaN-based LEDs formed on various substrates such as sapphire, wherein a "light-transmitting electrode" is formed above the p-side semiconductor layer(s) – and therefore, above the reflective layer (Office Action, page 6, lines 2-5).

The Office Action also recites that Nakamura states that "light transmitting" means at least 1% – but usually 20 to 40% – of light emitted from the semiconductor emitter is transmitted therethrough, and does not necessarily mean colorless, transparent; col. 4, lines 57-64 (Office Action, page 6, lines 7-9). The Office Action further recites that restated, the electrode may be either transparent, or partially transparent (Office Action, page 6, lines 9-10). The Office Action continues to recite that the present claims do not set forth any objective values for what percentage of light transmission constitutes "transparent;" as such layer 15 reads on the limitations regardless of whether the material specifically employed is fully transparent or partially transparent (Office Action, page 6, lines 10-13).

However, Applicants rely on the plain meaning of the word "transparent" and respectfully assert that a substance such as that in Nakamura, which transmits "at least 1% - but usually 20 to 40%" would not be construed by one of ordinary skill in the art as "transparent."

Furthermore, the independent claims recite at least the features of a transparent electrode and "a single reflective layer." Nowhere does Nakamura teach or suggest the features of a transparent electrode and a single reflective layer in the light-emitting device.

In addition, nowhere does Nakamura teach or suggest that a single reflective layer is directly disposed on a surface and the surface is opposite to a side wherein the light-emitting layer is located, as recited in new claims 59-62.

With respect to the rejection of claims 1-3, 5-10, 21, 26-34, 38, 40, and 41 under 35 U.S.C. §103(a) as obvious over Soules, Butterworth, Tsutsui, and Nakamura, Applicants respectfully submit that as argued below, Soules, Butterworth, Tsutsui, and Nakamura, either

individually or in combination, fail to teach or suggest every feature of independent claims 1 and 21.

Furthermore, Applicants also respectfully submit that Butterworth teaches away from the claimed invention. (Please see, MPEP, §2141.02).

Claim 1 recites at least the features of "a secondary light source comprising a fluorescent material ... and a fluorescent material resin, said fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion; and a sealing member that focuses light emitted from said light-emitting apparatus, said sealing member being disposed above said secondary light source."

Similarly, claim 21 recites at least the features of "a second light source including a first fluorescent material that absorbs said blue light emitted by said first light source and emits a green light and a fluorescent material resin, said first fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion; a sealing member that focuses light emitted from said light-emitting apparatus, said sealing member being disposed above said secondary light source."

Applicants respectfully submit that the unitary lens 240 of Butterworth is analogous to the combination of both the fluorescent material resin contained in the cup portion and the sealing member disposed above the secondary light source of the present invention. Therefore, Butterworth does not teach or suggest the features of the fluorescent material resin being contained in the cup portion and the sealing member being disposed above the secondary light source as recited in claims 1 and 21.

Furthermore, it is an object of Butterworth to eliminate the additional step of forming a phosphor layer, i.e., a phosphor layer corresponding to the fluorescent material resin of the present invention, to thereby reduce inventories of various colored LEDs by maintaining a stock of lens-less LEDs. Various colored LEDs may then be subsequently manufactured by adding a unitary selectively-colored lens that corresponds to both the fluorescent material resin and the sealing member of the present invention.

Applicants also respectfully submit that for the reasons outlined immediately above, Butterworth is an improper reference to establish prima facie obviousness, because

Butterworth teaches away from the two distinct elements of a fluorescent material resin contained in the cup portion and the sealing member disposed above the secondary light source (i.e., the fluorescent material resin).

Soules, Tsutsi, and Nakamura do not cure the deficiencies of Butterworth. As admitted by the Examiner, Soules does not disclose a fluorescent material resin contained in a cup portion. Applicants respectfully submit that nowhere does Tsutsi and Nakamura, either individually or in combination, teach or suggest the features of the fluorescent material resin contained in the cup portion and the sealing member disposed above the secondary light source as recited in claims 1 and 21.

Accordingly, the prior art of Soules, Butterworth, Tsutsi, and Nakamura, either individually or in combination, fail to render obvious the subject matter of claims 1 and 21, and claims 2, 3, 6-10, 26-28, 30-34, 38, 40, and 41 under 35 U.S.C. §103(a). This Amendment cancels without prejudice or disclaimer claims 5 and 29; hence, the rejection of claims 5 and 29 is moot. Furthermore, Applicants also respectfully submit that Butterworth is an improper reference to establish *prima facie* obviousness, because Butterworth teaches away from the two distinct claim elements of a fluorescent material resin contained in the cup portion and the sealing member disposed above the secondary light source. Withdrawal of the rejection of claims 1-3, 5-10, 21, 26-34, 38, 40, and 41 under 35 U.S.C. §103(a) as obvious over Soules, Butterworth, Tsutsi, and Nakamura is respectfully solicited.

E. The Hampden-Smith Reference

The Office Action cites Hampden-Smith for teaching various sulfur-containing phosphors that can be used, for example, in photoluminescence (Office Action, page 7, section 5.a). The Office Action also recites that the phosphors of Hampden-Smith include ZnS:Eu; ZnS:Cu, and ZnS:Cu, Au, Al; and CaS:Eu (Office Action, page 7, section 5.a).

Claim 11 recites at least the features of "a secondary light source comprising a fluorescent material ... and a fluorescent material resin, said fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion; and a sealing member that focuses light emitted from said light-emitting apparatus, said sealing member being disposed above said secondary light

source."

Nowhere does Hampden-Smith teach or suggest the two distinct claim elements of a fluorescent material resin contained in the cup portion and the sealing member disposed above the secondary light source as recited in claim 11.

Hampden-Smith does not cure the deficiencies of Soules, Butterworth, Tsutsi, and Nakamura as argued above in regard to the rejection of claims 1-3, 5-10, 21, 26-34, 38, 40, and 41 under 35 U.S.C. §103(a) and which may be similarly argued for the equivalent subject matter of claim 11.

For at least the reasons outlined above, Applicants respectfully submit that Soules, Butterworth, Tsutsi, Nakamura and Hampden-Smith, either individually or in combination, fail to disclose every feature of claim 11. Accordingly, Soules, Butterworth, Tsutsi, Nakamura and Hampden-Smith, either individually or in combination, fail to render obvious the subject matter of claim 11 and claims 12, 13, 16-19, and 39, which depend from claim 11, under 35 U.S.C. §103(a). This Amendment cancels claim 15 without prejudice or disclaimer; hence, the rejection of claim 15 is moot. Withdrawal of the rejection of claims 11-13, 15-20, and 39 under 35 U.S.C. §103(a) as unpatentable over Soules, Butterworth, Tsutsi, and Nakamura in further view of Hampden-Smith is respectfully solicited.

F. The Thompson Reference

The Office Action cites Thompson for teaching a full-color LED assembly comprising two LEDs and a photolumiscent downconverter phosphor disposed for re-emission of a longer wavelength of light in response to light that is emitted from only one of the two LEDs, wherein the phosphor may either emit green or red light.

Claim 21 recites at least the feature of "a second light source including a first fluorescent material that absorbs said blue light emitted by said first light source and emits a green light and a fluorescent material resin, said first fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion; a sealing member that focuses light emitted from said light-emitting apparatus, said sealing member being disposed above said secondary light source."

Nowhere does Thompson teach or suggest the two distinct claim elements of a

fluorescent material resin contained in the cup portion and the sealing member disposed above the secondary light source as recited in claim 21.

Thompson does not cure the deficiencies of Soules, Butterworth, Tsutsi, and Nakamura as argued above in regard to the rejection of claim 21 under 35 U.S.C. §103(a).

For at least the reasons outlined above, Applicants respectfully submit that Soules, Butterworth, Tsutsi, Nakamura and Thompson, either individually or in combination, fail to disclose every feature of claim 21. Accordingly, Soules, Butterworth, Tsutsi, Nakamura and Thompson, either individually or in combination, fail to render obvious the subject matter of claim 21 and claim 25, which depends from claim 21, under 35 U.S.C. §103(a). Withdrawal of the rejection of claim 25 under 35 U.S.C. §103(a) as unpatentable over Soules, Butterworth, Tsutsi, and Nakamura in further view of Thompson is respectfully solicited.

G. The Komoto Reference

The Office Action cites Komoto as teaching a GaN-based light emitter that preferably emits at wavelengths of 380 nm or less and which communicates with fluorescent materials for downconverting the primary light into various colors including white.

Claims 1 and 11 recite at least the features of "a leadframe comprising a cup portion including a bottom surface on which said GaN semiconductor light-emitting device is mounted; a secondary light source comprising a fluorescent material ... and a fluorescent material resin, said fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion; and a sealing member that focuses light emitted from said light-emitting apparatus, said sealing member being disposed above said secondary light source."

Similarly, claim 21 recites at least the features of "a leadframe comprising a cup portion including a bottom surface on which said GaN semiconductor light-emitting device is mounted; a second light source including ... and a fluorescent material resin, said first fluorescent material being dispersed within said fluorescent material resin, and said fluorescent material resin being contained in said cup portion; a sealing member that focuses light emitted from said light-emitting apparatus, said sealing member being disposed above said secondary light source."

After reviewing Figs. 1-141 of Komoto and the accompanying description, when appropriate, Applicants respectfully submit that Komoto does not teach or suggest the combination of claim elements recited in independent claims 1, 11, and 21.

In addition, Komoto does not cure the deficiencies of Soules, Butterworth, Tsutsi, and Nakamura as argued above in regard to the rejection of claims 1, 21, and 41 under 35 U.S.C. §103(a) and which may be similarly argued for the equivalent subject matter of claim 11.

Furthermore, Applicants respectfully submit that Soules, Butterworth, Tsutsi, Nakamura, and Komoto, either individually or in combination, do not teach or suggest every feature of claims 1, 11, 21, and 41. Accordingly, Soules, Butterworth, Tsutsi, Nakamura, and Komoto, either individually or in combination, fail to render obvious the subject matter of claims 1, 11, 21, and 41, and claims 43-46, 49 and 50, which depend from claims 1, 11, 21, and 41, under 35 U.S.C. §103(a). Withdrawal of the rejection of claims 43-46, 49, and 50 under 35 U.S.C. §103(a) as unpatentable over Soules, Butterworth, Tsutsi, and Nakamura (and Hampden-Smith as applied to claim 44) and further in view of Komoto is respectfully solicited.

III. THE 35 U.S.C. §112, FIRST PARAGRAPH, REJECTION

Claims 43-45 stand rejected under 35 U.S.C. §112, first paragraph.

Applicants respectfully assert that the subject matter of claims 43-45 is clearly illustrated by Fig. 7 of the Specification and clearly described at page 31, lines 9-12 of the Specification. Withdrawal of the rejection of claims 43-45 under 35 U.S.C. §112, first paragraph, is respectfully solicited.

IV. CONCLUSION

In view of the foregoing, Applicants submit that claims 1-3, 6-13, 16-22, 25-28, 30-34, 38-46, and 50-62, all of the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed

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below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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